

## CLAIMS

### WHAT IS CLAIMED IS:

1. A semi-insulating zinc-oxide (ZnO) single crystal.
2. The crystal of claim 1 wherein the resistivity of the crystal is in a range from  $1.5 \times 10^3$  to  $10^9$  ohm-centimeter ( $\Omega$ -cm).
3. The crystal of claim 1 wherein the resistivity of the crystal is sufficient to achieve electrical isolation of a device to be formed thereon.
4. The crystal of claim 1 wherein the crystal is produced from a melt.
5. The crystal in claim 1 wherein the crystal is a substrate that is grown as a bulk single crystal, cut, and processed to a specified thickness.
6. The crystal in claim 1 wherein the crystal contains a dopant that increases the resistivity of the crystal relative to intrinsic ZnO.
7. The crystal of claim 6 wherein the dopant is added to the ZnO single crystal in an atomic concentration ranging from  $1 \times 10^{15}$  atoms per cubic centimeter (atoms/cc) to  $5 \times 10^{21}$  atoms/cc.
8. The crystal of claim 6 wherein the dopant comprises lithium (Li).
9. The crystal of claim 6 wherein the dopant comprises sodium (Na).
10. The crystal of claim 6 wherein the dopant comprises copper (Cu).
11. The crystal of claim 6 wherein the dopant comprises nitrogen (N).

12. The crystal of claim 6 wherein the dopant comprises phosphorus (P).
13. The crystal of claim 6 wherein the dopant comprises manganese (Mn).
14. A method comprising:  
forming a semi-insulating zinc-oxide (ZnO) single crystal.
15. The method of claim 14 wherein the crystal is formed with a resistivity in a range from  $1.5 \times 10^3$  to  $10^9$  ohm-centimeter ( $\Omega$ -cm).
16. The method of claim 14 wherein the crystal is formed with a resistivity sufficient to achieve electrical isolation of a device to be formed thereon.
17. The method of claim 14 wherein the crystal is formed from a melt.
18. The method in claim 14 wherein the crystal is formed as a substrate that is grown as a bulk single crystal, cut, and processed to a specified thickness.
19. The method in claim 14 wherein the crystal is formed with a dopant that increases the resistivity of the crystal relative to intrinsic ZnO.
20. The method of claim 19 wherein the dopant is added to the ZnO single crystal in an atomic concentration ranging from  $1 \times 10^{15}$  atoms per cubic centimeter (atoms/cc) to  $5 \times 10^{21}$  atoms/cc.
21. The method of claim 19 wherein the dopant comprises lithium (Li).
22. The method of claim 19 wherein the dopant comprises sodium (Na).
23. The method of claim 19 wherein the dopant comprises copper (Cu).

24. The method of claim 19 wherein the dopant comprises nitrogen (N).

25. The method of claim 19 wherein the dopant comprises phosphorus (P).

26. The method in claim 19 wherein the dopant comprises manganese (Mn).